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Analysis of Compaction Wave Dissipation in Porous Metalized Explosive[1] PRATAP RAO, KEITH GONTHIER, Mechanical and Industrial Engineering Department, Louisiana State University — It is well established that the inclusion of reactive metals in explosive formulations can enhance post-detonation energy release but it remains unclear, even for idealized systems, how the composition and microstructure of metal containing porous solid explosives affects dissipative heating within compaction waves that is important for weak initiation of detonation. In this study, we perform inert meso-scale simulations to computationally examine how the initial porosity and metal mass fraction of aluminized HMX influences dissipation within compaction waves and we compare predictions to those given by a macro-scale compaction theory. The meso-scale model uses a hyperthermoelastic-viscoplastic and stick-slip friction theory to track the evolution of thermomechanical fields within individual particles that result from pore collapse within waves. Effective quasi-steady wave profiles are obtained by averaging meso-scale fields over space and time. The macro-scale theory predicts the variation in effective thermomechanical fields within waves due to imbalances in phase-specific pressures and configurational stresses. Qualitative agreement exists between meso-scale and macro-scale predictions.

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